Amendments to the Specification:

Please replace paragraphs with the amended paragraphs below:

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**[0016]** The structure according to the invention is self-adjusting because the hub elements are not necessarily precisely spaced from each other, but are, rather, assembled in an approximate fashion arranged according to some general principle with virtual struts automatically forming along the single-axis curvature that extends from vertex to vertex. The geodesic dome thus constructed will have an overall shape with a curvature that corresponds to an average curvature of all the hub elements, as will be discussed below. Furthermore, the geodesic dome according to the invention is self-triangulated. If lines are drawn from each vertex to adjacent vertexes, one can see that the entire structure is divided into triangles, albeit triangles of varying dimensions, including scalene triangles in which each leg of the triangle is a different length.

Following paragraph **[0045]** please enter the following paragraphs:

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**[0046]** **FIG. 14** is an orthogonal view of a partial cross-section of the dome **100** of **FIG. 5**

**[0047]** **FIG. 15** shows a partial view of a geodesic structure according to the present invention, constructed of truncated conical hub elements.

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**[0048]** **FIG. 16** shows a partial view of a geodesic structure according to the present invention, constructed of tensegrity elements.

## DETAILED DESCRIPTION OF THE INVENTION

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~~[0045]~~ [0049] **FIG. 1** shows a dome (prior art) based on the icosahedron, which is

the basis for almost all geodesic structures or domes that are constructed. A polygonal single-frequency icosahedron and a corresponding spherical icosahedron are shown in **FIGS. 2** and **3**, respectively.

~~[0046]~~ [0050] **FIG. 4** shows a first embodiment of a dome **100** according to the present invention and **FIG. 5** shows a hub element 5. The dome **100** comprises a plurality of the hub elements **5**, arranged so ~~as to overlap~~ that each individual hub element 5 overlaps with adjacent hub elements **5**. As can be seen in **FIG. 5,** a section of material **9** is removed from a planar disc **8** between an imaginary vertical line $l_2$ that extends from the center of the planar disc **8** to a hub base **7** and a deficit line **6** to create an angular deficit $\alpha$ in the hub element **5**. The edges that form the angular deficit $\alpha$ are then brought together and fastened, so as to form the hub element **5**. The center of the planar disc **8** now forms a ~~having the~~ vertex **V**. Referring to **FIG. 4**, virtual struts **S** are indicated by dotted lines that extend between the vertexes **V**. In this first embodiment, the hub element **5** is made from a plastic-coated disc of a paper-honeycomb-sandwich-construction. Many other stiffly flexible materials are suitable for the hub elements **5**, such as, but not limited to, sheet metal, oriented-strand board, sheet plastic, paperboard, corrugated cardboard, wood, fiberglass, carbon fiber, leather, woven fiber, including plant fiber, etc., or suitable combinations of material.

~~[0047]~~ [0051] Also shown in ~~FIG.~~ **FIGS. 5** and **14** is an angle of structure $\theta$, also referred to as an external angle $\theta$ and, when referring to this first embodiment, a dome angle $\theta$. As shown, the angle of structure $\theta$ is formed by an imaginary straight line $l_1$ that extends from the plane of a first side of the hub element **5** beyond the vertex **V** and the plane of a second side of the hub element **5**. For purposes of illustration, the radius **R** of the dome **100** is 5 m, the dome angle $\theta$ is 10°, and the number of hub elements **5** and ~~the~~ a strut length **SL** are to be calculated. **FIG. 14** shows an orthogonal view of a partial cross-section of the geodesic dome **100** constructed according to the first embodiment of the invention. Several hub elements $5_A$, $5_B$, and $5_C$, each with a vertex

$V_A$, $V_B$, and $V_C$, respectively, and an internal angle $\beta$, are shown arranged around a diameter of the dome **100**. The overlap between adjacent hub elements **5** is the maximal overlap, whereby the outer perimeter of hub element $5_A$, for example, approaches the vertexes of adjacent hub elements $5_B$, and $5_C$.

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~~[0048]~~ [0052] To calculate the number of hub elements **5** needed for a semisphere, the solid angle of 360° is divided by the angular deficit $\alpha$. Knowing that the dome angle $\theta$ is 10°, the internal angle $\beta$ is then equal to (180° - $\theta$)/2, which is 85°. The angular deficit $\alpha$ is equal to 360°(1 - sin $\beta$), which is 1.4°. The number of hub elements **5** required is then 360°/1.4°, that is, 257 hub elements **5**. To calculate the hub length **L**, shown in **FIG. 5**, we first calculate the strut length **SL**, that is, the distance between vertexes **V** of the hub elements **5**. As can be seen in **FIG.** ~~7~~ **14**, the strut length **SL** is equal to *sin* $\theta$ x $R_A$, which, in this particular embodiment, is (0.174)(5 m) = 0.87 m. The minimum hub length $\mathbf{L_{min}}$ is **SL/2** and the maximum hub length $\mathbf{L_{max}}$ is slightly shorter than the strut length **SL**. With hub length $\mathbf{L_{min}}$ and hub elements **5** that are arranged so as to just tangentially contact adjacent elements **5**, the geodesic dome **100** comprising the **257** hub elements **5** described above will have a dome angle $\theta$ of 10°, a radius **R** of 5 m, an angular deficit $\alpha$ of 1.4°, and strut length **SL** of 0.87 m. Any amount of overlap between adjacent hub elements **5** must be added to the minimum hub length to determine the actual hub length **L**.

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~~[0049]~~ [0053] In this first embodiment, the hub elements **5** are overlapped and, depending on the amount of overlap, the diameter of the resulting dome will be greater or smaller, but the dome angle $\theta$ will be 10°. The hub elements **5** can be overlapped maximally such that the outer edge of one element approaches the vertex **V** of each element that is immediately adjacent to it, or can be overlapped by any lesser amount that is still adequate to provide a completely enclosed space within the dome **100**.

~~[0050]~~ [0054] In the example described above, the dome angle $\theta$, which

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corresponds to the external angle $\theta$, was known to be 10°. The external angle $\theta$ is the amount of deflection between one leg of the hub element **5** and an extended line from the other leg of the same hub element **5** at the vertex **V**. As can be seen in **FIG. ~~6~~ 14**, (2 x sin $\beta$) + $\theta$ is equal to 180°. If the angular deficit $\alpha$ of the hub element **5** is known, the external angle $\theta$ of the hub element **5** and the angle of structure $\theta$ of the structure can be calculated because, based on simple trigonometric equations, it is known that sin $\beta$ equals (1- $\alpha$/180°). So, for example, if the angular deficit $\alpha$ is approximately 1.4°, the dome angle $\theta$ of the dome **100** is approximately 10°.

**~~[0051]~~ [0055]** Since $\theta$ is a function of the angular deficit $\alpha$ of the hub element **5**, it is possible to first define the dimension of the angular deficit $\alpha$ and then derive the other variables. If the Preferred Embodiment of the geodesic dome **100** is to be constructed of hub elements **5** that are provided as flat, circular sheets, it is a relatively simple matter to calculate the amount of material that must be removed from the circular sheets to produce suitable hub elements **5**. If the desired dome angle $\theta$, the desired radius, and the number of available sheets are known, the angular deficit $\alpha$ to construct a dome with the desired dimensions can be calculated. So, for example, if the desired dome angle $\theta$ is 8.5°, the angular deficit $\alpha$ = 360(1-sin $\beta$). The internal angle $\beta$ = (180° – 8.5)/2 = 85.75°. Therefore, $\alpha$ = 0.99°. The number of hub elements **5** and the strut length **SL** are calculated as in the previous example.

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**~~[0052]~~ [0056]** The number of hub elements **5** required to construct a particular dome depends on the strut length **SL**, the fraction of a sphere that the dome is to encompass, and the desired radius. It is, of course, possible to have a given number of hub elements **5** with a given angular deficit $\alpha$ and a given dimension for the overlap, and from these, determine the size of dome that can be constructed. The purpose of this illustration is not to limit the scope of the invention in any way, but rather, to show that a geodesic dome according to the present invention can be constructed to approximate dimensions, using only very basic mathematical skills and a basic

calculator that has trigonometric functions. The construction according to the present invention is referred to as a "self-adjusting" structure, meaning that the individual hub elements **5** can be approximately arranged in an overlapping manner and can be adjusted with more or less overlap to compensate for partial elements that would be required mathematically to make a sphere. For example, if the angular deficit $\alpha$ is 7°, the number of hub elements **5** required to construct a dome according to the method of the present invention is 51.4. The dome can be constructed with 51 or with 52 hub elements **5**, some of which are adjusted slightly to overlap more or less to accommodate for the missing or added partial element.

B9 Con't

~~[0053]~~ [0057] **FIGS. 6, 7, 8,** and **9** illustrate other types of hub elements that can be used to construct further embodiments of a geodesic structure according to the present invention. **FIG. 6** shows a ~~tapered~~ truncated cone **11** for constructing a first alternative embodiment, **FIG. 7** a tapered triangle **12** for constructing a second alternative embodiment, and **FIGS. 8** and **9** show strutted frame elements **13** and **14**, respectively, for constructing third and fourth alternative embodiments, respectively, of the geodesic structure according to the present invention. **FIG. 10** shows a partial view of the second alternative embodiment of a dome **200** constructed of the tapered triangular elements **12** and a skin **17**. Each triangular element **12** has a wide end **12A** and a narrow end **12B**. The elements **12** are arranged such that each element **12** is touching adjacent elements **12**, with the narrow end **12B** facing in toward the center of the dome **200** forming the concave inner surface and the wide end **12A** forming the outer convex surface. The first alternative embodiment according to the present invention uses the ~~tapered~~ truncated cones **11**, is constructed similarly to the dome **200**, and is also covered with a skin, as shown in **FIG. 15.**

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~~[0054]~~ [0058] **FIG. 11** shows a partial surface of the third alternative embodiment according to the present invention of a dome being constructed with the strutted frame elements **13.** The elements **13** are hexagonal in shape and comprise three struts **13A**

that are crossed in the center so as to form the hexagonal shape. A tension element **15** forms the perimeter of the strutted frame element **13** and is fastened with sufficient tension to force the struts **13A** into a slightly bowed or convex-concave configuration. In this third alternative embodiment, strut ends **13B** protrude beyond the perimeter of the strutted frame element **13**. Adaptable couplers **16** are used to couple two strut ends **13B** of two adjacent strutted frame elements **13**. A plurality of frame elements **13** can be connected to form a sphere having the dome angle **θ** corresponding to the dome angle **α** of the strutted frames **13**. The dome constructed of such elements is then covered with a skin, similar to the dome **200** described above<u>, as shown in **FIG. 16**</u>.

~~[0055]~~ <u>[0059]</u> **FIG. 12** illustrates a very simple type of adaptable coupler **16**, which is a tube, open at both ends. The strut ends **13B** of two different strutted frame elements **13** can be inserted into the coupler **16**. The coupler **16** is long enough to slidably hold the strut ends **13B** within the coupler **16**, yet allow the strut ends **13B** to slidably adjust the position of the strutted frame elements **13** in place within the structure under construction. Many types of adaptable couplers **16** are available and suitable for holding the strutted frame elements **13** in a proper relationship to the other strutted frame elements **13** in the structure. Suitable couplers include clamps or tubes with holes or slots through which set screws or locking pins are insertable to hold the strut ends **13** in position.

~~[0056]~~ <u>[0060]</u> **FIG. 13** illustrates a fifth embodiment of the invention, a map **500** of the earth. For purposes of illustration only, Oslo, Norway is the major point of interest on the map **500** and is located somewhat near the center of the map **500**. The intended application of the map is to illustrate travel routes from Oslo to other points in the world. Initially, orthogonal projections of places of major interest are projected onto a sphere, each place of major interest surrounded by vertexes **18**. Attention is given not to place the vertexes **18** on areas of particular interest, but instead, to place them in

areas of lesser interest, with respect to the particular focus of the map **500**. Connecting lines **19** are drawn on the sphere to connect the adjacent vertexes **18.** The resulting pattern made by the connecting lines **19** shows that the map **500** is omni-triangulated and that the triangles vary in size and are in some instances scalene triangles. The map **500** is then cut along some of the connecting lines **19** to allow the map **500** to lie flat. The map **500** has very little distortion, as the entire map is constructed of cartographic images of limited sections of the earth taken as orthogonal views.

**~~[0057]~~ [0061]** The embodiments mentioned herein are merely illustrative of the present invention. It should be understood that variations in construction and assembly of the present invention may be contemplated in view of the following claims without straying from the intended scope and field of the invention herein disclosed.